

Nalco Docket No.: 7560-NES
Customer No. 000049459

OFFICIAL**CLAIMS**

1. (cancelled)
2. (cancelled)
3. (cancelled)
4. (previously presented) The demulsifier composition of claim 3 wherein the amine capping monomer is selected from the group consisting of diethanolamine, N,N,N'-(trimethyl)-1,3-propanediamine, N-Methyl-D-glucamine and mixtures thereof.
5. (previously presented) The demulsifier composition of claim 62 wherein the diglycidyl ether of an aliphatic diol is selected from the group consisting of the diglycidyl ether of neopentyl glycol, diglycidyl ether of 1,4 butanediol, diglycidyl ether of ethylene glycol, diglycidyl ether of polyethylene glycol having a number average molecular weight, Mn, of about 526, and mixtures thereof, and the second amine monomer is (dimethylamino)-propylamine.
6. (previously presented) The demulsifier composition of claim 4 wherein an N-alkylating agent is reacted with amine groups of the oligo- and polymeric reaction products.
7. (previously presented) The demulsifier composition of claim 6 wherein the N-alkylating agent is an epihalohydrin-reacted polyalkoxide.
8. (previously presented) The demulsifier composition of claim 7 wherein the epihalohydrin is epichlorohydrin.
9. (previously presented) The demulsifier composition of claim 6 wherein the N-alkylating agent further comprises a polyoxyalkylene group.
10. (previously presented) The demulsifier composition of claim 9 wherein the polyoxyalkylene group is selected from the group consisting of polyethoxy groups, polypropyloxy groups and mixtures thereof.

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11. (previously presented) The demulsifier composition of claim 10 wherein the polyoxyalkylene group has a propoxy to ethoxy ratio of from 9 to 1 to about 1 to 9.
12. (previously presented) The demulsifier composition of claim 9 wherein the polyoxyalkylene group is methoxy-capped polyethylene oxide.
13. (previously presented) The demulsifier composition of claim 6 wherein the N-alkylating agent is an epichlorohydrin capped polyoxyalkylene glycol methyl ether.
14. (previously presented) The demulsifier composition of claim 6 further comprising at least one C₁ to C₁₆ alcohol and at least one acid-containing compound.
15. (cancelled)
16. (previously presented) The demulsifier composition according to claim 63 wherein an amine capping monomer having one or two reactive amino hydrogens is subsequently reacted with terminal epoxy groups on the oligo- and polymeric reaction products.
17. (previously presented) The demulsifier composition according to claim 16 wherein the amine capping monomer is selected from the group consisting of diethanolamine, N, N, N'- (trimethyl)-1,3-propanediamine, N-methyl-D-glucamine and mixtures thereof.
18. (previously presented) The demulsifier composition according to claim 16 wherein the amine capping monomer further comprises at least one tertiary amine group.
19. (previously presented) The demulsifier composition according to claim 18 wherein an N-alkylating agent is reacted with amine groups of the oligo- and polymeric reaction products.
20. (previously presented) The demulsifier composition according to claim 19 wherein the N-alkylating agent comprises an epichlorohydrin-reacted polyalkoxide.
21. (previously presented) The demulsifier composition according to claim 20 wherein the epichlorohydrin is epichlorohydrin or epibromohydrin.

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22. (previously presented) The demulsifier composition according to claim 19 wherein the N-alkylating agent containing group further comprises a polyoxyalkylene group.
23. (previously presented) The demulsifier composition according to claim 22 wherein the polyoxyalkylene group is selected from polyethoxy groups, polypropyloxy groups and mixtures thereof.
24. (previously presented) The demulsifier composition according to claim 22 wherein the polyoxyalkylene group is methoxy capped polyethylene oxide.
25. (previously presented) The demulsifier composition according to claim 19 wherein the N-alkylating agent containing group is an epichlorohydrin capped polyoxyalkylene glycol methyl ether.
26. (previously presented) The demulsifier composition according to claim 19 further comprising at least one C₁ to C₁₆ alcohol and at least one acid-containing compound.
27. (previously presented) The demulsifier composition according to claim 63, wherein the diglycidyl ether of an aliphatic diol is selected from the group consisting of the diglycidyl ether of neopentyl glycol; the diglycidyl ether of butanediol; the diglycidyl ether of ethylene glycol; the diglycidyl ether of polyethylene glycol and mixtures thereof; and the second amine monomer is N, N-dimethylamino propylamine.
28. (currently amended) A demulsifier composition comprising oligo- and polymeric compounds, wherein the oligo- and polymeric compounds are selected from the group consisting of compounds prepared by reaction products of an amine having only two reactive amino hydrogens, an aliphatic or cycloaliphatic epoxidized olefin having two epoxide groups, and a second amine monomer having only two reactive amino hydrogens and a tertiary amine group and optional subsequent reaction of epoxy groups of the oligo- and polymeric reaction products with an amine capping monomer having one or two reactive amino hydrogens and optional subsequent reaction of amine groups of the oligo- and polymeric reaction products with an N-alkylating agent.

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29. (canceled)
30. (currently amended) The demulsifier composition according to claim ~~29~~ 28 wherein the amine capping monomer further comprises at least one tertiary amine group.
31. (currently amended) ~~The A~~ demulsifier composition ~~according to claim 30~~ comprising the oligo- and polymeric compounds selected from the group consisting of compounds prepared by reaction products of an amine having only two reactive amino hydrogens, an epoxidized olefin having two epoxide groups, a triglycidyl ether of an aliphatic triol, and a second amine monomer having only two reactive amino hydrogens and a tertiary amine group and subsequent reaction of epoxy groups of the oligo- and polymeric reaction products with an amine capping monomer having one or two reactive amino hydrogens and and at least one tertiary amine group.
32. (canceled)
33. (currently amended) The demulsifier composition according to claim ~~32~~ 28 wherein the N-alkylating agent is an epihalohydrin-reacted polyalkoxide compound.
34. (previously presented) The demulsifier composition according to claim 33 wherein the epihalodrin is epichlorohydrin or epibromohydrin.
35. (currently amended) The demulsifier composition according to claim ~~32~~ 28 wherein the N-alkylating agent further comprises an oxyalkylene group.
36. (previously presented) The demulsifier composition according to claim 35 wherein the oxyalkylene group is a polyoxyalkylene wherein the polyoxyalkylene group is selected from polyethoxy groups, polypropyloxy groups or mixtures thereof.
37. (previously presented) The demulsifier composition according to claim 36 wherein the polyoxyalkylene group has a propoxy to ethoxy ratio of from 9 to 1 to about 1 to 9.

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38. (previously presented) The demulsifier composition according to claim 32 wherein the N-alkylating agent is an epichlorohydrin capped polyoxyalkylene glycol methyl ether.
39. (previously presented) The demulsifier composition according to claim 35 wherein the polyoxyalkylene group is methoxy-capped polyethylene oxide.
40. (previously presented) The demulsifier composition according to claim 32 further comprising at least one C₁ to C₁₆ alcohol and at least one acid-containing compound.
41. (canceled)
42. (previously presented) A demulsifier composition comprising the oligo- and polymeric reaction products of at least one first amine having only two reactive hydrogens, selected from the group consisting of methylamine, ethylamine, propylamine, butylamine, sec-butylamine, isobutylamine, 3,3-dimethylbutylamine, hexylamine and benzylamine, 2-amino-1-butanol, 4-amino-1-butanol, 2-amino-2-methyl-1-propanol, 6-amino-1-hexanol, ethanolamine, propanolamine, tris(hydroxymethyl) aminomethane, D-glucamine, 3-amino-1,2-propanediol, 2-amino-2-methyl-1,3-propanediol, 2-amino-2-ethyl-1,3-propanediol, 3-(dimethylamino)propylamine, N,N-dimethylethylenediamine, N,N-diethylethylenediamine, 1-(2-aminoethyl)piperidine, 4-(2-aminoethyl)morpholine, 2-(2-aminoethyl)-1-methylpyrrolidine, 1-(2-aminoethyl)pyrrolidine, 2-(2-aminoethyl)pyridine, 2-(2-aminoethylamino)ethanol, piperazine, 2-methyl piperazine, 2,6-dimethylpiperazine, 2-(methylamido)piperazine, N,N'-bis(2-hydroxyethyl)ethylenediamine, N,N'-dimethylethylenediamine, N,N-dimethyl-1,4-phenylenediamine and N,N'-dimethyl-1,6-hexanediamine;
- (b) at least one second amine having only two reactive amino hydrogens and a tertiary amine group selected from the group consisting of 3-(dimethylamino)propylamine, N,N-dimethylethylenediamine, N,N-diethylethylenediamine, 1-(2-aminoethyl)piperidine, 4-(2-aminoethyl)morpholine, 2-(2-aminoethyl)-1-methylpyrrolidine, 1-(2-aminoethyl)pyrrolidine, and 2-(2-aminoethyl)pyridine;

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(c) at least one diepoxy-containing compound said diepoxy compound selected from the group consisting of: bis(2,3-epoxypropyl)ether, diglycidyl ether of 1,4-butanediol, diglycidyl ether of neopentyl glycol, diglycidyl ether of ethylene glycol, glycerol diglycidyl ether, diglycidyl ether of polyethyleneglycol, diglycidyl ether of polypropylene glycol, the diglycidyl ether from the reaction product of ethylene oxide with propylene oxide, diglycidyl ester of cyclohexane dimethanol and diglycidyl ester of a dimer acid, 1,2,3,4-diepoxybutane; 1,2,7,8-diepoxyoctane, 1,2,9,10-diepoxydecane and 1,2,5,6-diepoxcyclooctane;

(d) at least one amine capping monomer having one or two reactive amino hydrogens, wherein said capping monomer is reacted with terminal epoxy groups on said oligo- and polymeric reaction products, the amine capping monomer being selected from the group consisting of diethanolamine, diisopropanolamine, N-methyl-D-glucamine, N-methylpropylamine, dimethylamine, diethylamine, dipropylamine, diisopropylamine, N,N,N'-trimethyl-1,3-propanediamine, N,N,N' - trimethylethylenediamine, N,N-dimethyl-N'-ethylethylenediamine, N,N,N'-triethylethylenediamine; and

(e) at least one N-alkylating epichlorohydrin capped polyalkylene glycol methyl ether having the following formula:

$R8-O-[CH_2-CH(R9)-O]_n-CH_2-CH(OH)-CH_2-X$ where:

R8 is hydrogen, C₁ to C₆ alkyl, C₆-C₁₀ aryl, 2-hydroxy-3-chloropropyl, or 2,3-oxopropyl,

R9 is hydrogen, or C₁ to C₆ alkyl,

X is a halogen atom, and n in the range of 1 to 120.

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43. (previously presented) The demulsifier composition according to claim 42, further comprising the oligo- and polymeric reaction product of an amine having only two reactive amino hydrogens selected from the group consisting of: 2-(2-aminoethoxy) ethanol; $\text{CH}_3\text{OCH}_2\text{CH}_2\text{O}[\text{CH}(\text{-CH}_3)\text{CH}_2\text{O}]_n\text{CH}_2\text{CH}(\text{-NH}_2)\text{CH}_3$ where n is at least one; $\text{CH}_3\text{-O-(CH}_2\text{CHR-O)}_n\text{-CH}_2\text{CH}(\text{-CH}_3)\text{NH}_2$ where n is at least one; and $\text{H}_2\text{N-CH}_2\text{CH}_2\text{OCH}_2\text{CH}_2\text{-OH}$, a diepoxy-containing compound, and a triepoxy-containing compound.
44. (previously presented) A demulsifier composition comprising oligo- and polymeric reaction products of
- (a) a first amine having only two reactive amino hydrogens selected from the group consisting of: ethanolamine, propanolamine, and polyoxyalkylamines according to the formula
- $\text{R}_4\text{-(CH}_2\text{CH(R}_5\text{)O)}_n\text{-CH}_2\text{CH(CH}_3\text{)NH}_2$, where R_4 is -OCH_3 , R_5 is hydrogen or -CH_3 , and n is 1 to 45, 2-(2-aminoethylamino)ethanol, piperazine, N,N-bis(2-hydroxyethyl)ethylenediamine, and N,N'-dimethylethylenediamine and mixtures thereof;
- (b) a diepoxy compound selected from the group consisting of diglycidyl ether of 1,4-butanediol, diglycidyl ether of neopentyl glycol, diglycidyl ether of ethylene glycol, diglycidyl ether of polyethyleneglycols, 1,2,3,4-diepoxybutane, 1,2,7,8-diepoxyoctane and mixtures thereof;
- (c) an amine capping monomer having one or two reactive amino hydrogens subsequently reacted with terminal epoxy groups, selected from the group consisting of diethanolamine, N-methyl-D-glucamine, N-methylpropylamine, N,N,N'-trimethyl-1,3-propanediamine, N,N,N'-trimethylethylenediamine, and mixtures thereof, and;

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(d) an N-alkylating epichlorohydrin capped polyalkylene glycol methyl ether-containing group having the formula:



where n is 100 to 113 and R9 is selected from the group consisting of hydrogen and a C₁ to C₆ alkyl group.

45. (previously presented) The demulsifier composition according to claim 44, wherein (a) further comprises a second amine monomer having only two reactive amino hydrogens and a tertiary amine group selected from the group consisting of 3-(dimethylamino)propylamine, N,N-dimethylethylenediamine, and mixtures thereof.
46. (previously presented) The demulsifier composition according to claim 44, further comprising at least one C₁ to C₁₆ alcohol and at least one acid-containing compound.
47. (previously presented) The demulsifier composition according to claim 46 further comprising a compound selected from the group consisting of alkyleneoxide copolymers, oxyalkylated alcohols, organo-phosphate esters, inorganic phosphate esters, polyglycols, resole resins, novalac resins and mixtures thereof.
48. (previously presented) The demulsifier composition according to claim 46 further comprising, an acid selected from the group consisting of arylalkylsulfonic acid; aqueous hydrochloric acid, hydrofluoric, sulfamic, acetic acid, formic acid, nitric acid, citric acid, ethylenediaminetetraacetic acid, nitriloacetic acid and mixtures thereof.
49. (previously presented) A method of treating an oil bearing formation comprising the steps of: charging an oil bearing formation with an effective amount of the demulsifier composition according to claim 46 blended per 1000 gallons of an aqueous organic or aqueous inorganic acid solution.

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50. (previously presented) The method of treating an oil bearing formation according to claim 49 wherein the effective amount of demulsifier composition is in the range of 0.01 to about 5 gallons per 1000 gallons of an added aqueous acidic solution.
51. (previously presented) A method of preparing a polymeric demulsifier compound comprising the steps of:
- a) reacting 0.5 to 1.4 moles of amines having only two reactive amino hydrogens with 1.0 mole of a diglycidyl ether of a glycol or epoxidized olefin and heating the reactants to between 25 °C to 240 °C for a period of time sufficient for the reaction product to attain a viscosity of at least 80,000 cps; and subsequently
 - b) capping unreacted glycidyl or epoxy groups on the polymeric reaction product with an amine monomer having only two reactive amino hydrogens and a tertiary amine group; and
 - c) alkylating amine groups on the polymeric reaction product with a N-alkylating agent-containing group to provide a polymeric demulsifier compound.
52. (previously presented) The method of claim 51 further comprising the step of adding a second amine monomer having only two reactive amino hydrogens and a tertiary amine group to the reaction.
53. (currently amended) The method of claim 51 wherein the amines having only two reactive amino hydrogens are selected from the group consisting of 2-(2-aminoethoxy) ethanol; $\text{CH}_3\text{OCH}_2\text{CH}_2\text{O}[\text{CH}(\text{CH}_3)\text{CH}_2\text{O}]_n\text{CH}_2\text{CH}(\text{NH}_2)\text{CH}_3$ where n is at least one; and $\text{CH}_3-(\text{CH}_2\text{CHRO})_n-\text{CH}_2\text{CH}(\text{CH}_3)\text{NH}_2$ where n is at least one.
54. (cancelled)

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55. (previously presented) The method of claim 51, further characterized by reacting 0.7 to 1.2 moles of at least one amine having only two active amino hydrogens, and a second amine monomer having only two reactive amine hydrogens and a tertiary amine group with one mole of diglycidyl ether of a glycol or epoxidized olefin between 25 °C to 240 °C for a time period sufficient for the reaction product to reach a viscosity of at least 80,000 cps.
56. (original) The method of claim 51 further characterized by grafting an N-alkylating agent onto the polymer by reacting the polymer and N-alkylating agent a weight ratio of between 1:1 to 8:1 at a pH between 7.5 and 9.0 at a temperature between 60 °C and 95 °C for a time period sufficient to reach a solution viscosity between 200 and 9000 cps.
57. (original) The method of claim 51 further characterized by grafting the N-alkylating agent onto the polymer at a weight ratio of between 1:1 to 8:1 of polymer to N-alkylating agent, at a pH between 7.5 and 9.0 and at a temperature between 85 °C and 95 °C for a time sufficient to produce a viscosity between 200 and 5000 cps.
58. (original) The method of claim 51 wherein the N-alkylating agent is epichlorohydrin capped polyalkylene glycol methyl ether.
59. (previously presented) The method of claim 51 further comprising the step of protonating the polymeric reaction product after steps a and b with an acid.
60. (previously presented) A demulsifier composition comprising the polymeric reaction product of
- 1) 0.8:1 to about 1.3:1 molar equivalents relative to diepoxy-containing compound of at least one first amine-containing group having only two reactive amino hydrogens selected from the group consisting of

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(a) methylamine, ethylamine, propylamine, butylamine, sec-butylamine, isobutylamine, 3,3-dimethylbutylamine, hexylamine, benzylamine, 2-amino-1-butanol, 4-amino-1-butanol, 2-amino-2-methyl-1-propanol, 6-amino-1-hexanol, ethanolamine, propanolamine, tris(hydroxymethyl)aminomethane, 1-amino-1-deoxy-D-sorbitol (D-glucamine), 3-amino-1,2-propanediol, 2-amino-2-methyl-1,3-propanediol, 2-amino-2-ethyl-1,3-propanediol, 3-(dimethylamino)propylamine, N,N-dimethylethylenediamine, N,N-diethylethylenediamine, 1-(2-aminoethyl)piperidine, 4-(2-aminoethyl)morpholine, 2-(2-aminoethyl)-1-methylpyrrolidine, 1-(2-aminoethyl)pyrrolidine, 2-(2-aminoethyl)pyridine, 2-(2-aminoethylamino)ethanol, piperazine, 2-methyl piperazine, 2,6-dimethylpiperazine and 2-(methylamido)piperazine, N,N'-bis(2-hydroxyethyl)ethylenediamine, N,N'-dimethylethylenediamine, N,N'-dimethyl-1,4-phenylenediamine and N,N'-dimethyl-1,6-hexanediamine;

(b) amines of formula $\text{NH}_2\text{-R1-Z1}$; and

(c) amines of formula $\text{HN (R1Z1)-R3-NH- (R1Z1)}$;

wherein R1 is $(\text{-CH}_2\text{-CH}_2\text{-O-})_n$, $(\text{-CH}_2\text{-CH}(\text{-CH}_3)\text{-O-})_n$, or $(\text{-CH}_2\text{-CH}_2\text{-O-})_m\text{-(CH}_2\text{CH}(\text{-CH}_3)\text{-O-})_p$ where n, m and p are 1 to 45; R3 is a $\text{C}_2\text{-C}_{20}$ alkylene or $\text{C}_2\text{-C}_{20}$ substituted alkylene wherein the substituent are selected from the group consisting of alkylamido, hydroxy, alkoxy, halo, cyano, aryloxy, alkylcarbonyl, arylcarbonyl, and mixtures thereof; and Z1 is hydrogen, alkyl or acyl;

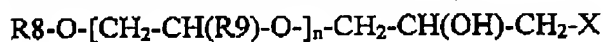
2) at least one diepoxy-containing compound selected from compounds of formula:
Epoxy- $\text{CH}_2\text{-O-(R6-O)}_n\text{-CH}_2\text{-Epoxy}$; and Epoxy- $\text{CH}_2\text{-R7-CH}_2\text{-Epoxy}$

wherein R6 is selected from C_2 to C_{20} alkylene; alkyl substituted C_2 to C_{20} alkylene, C_2 to C_{40} alkoxy, and C_2 to C_{40} hydroxy substituted alkoxy; n is 0 to 20; and R7 is a C_2 to C_{20} alkylene, or a substituted alkylene; and

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3) subsequently reacting the polymeric reaction product of 1) and 2) with at least one N-alkylating agent selected from the group consisting of epihalohydrin capped polyalkylene glycol methyl ether of formula



wherein R8 is selected from hydrogen, C₁-C₆ alkyl, C₆-C₁₀ aryl, 2-hydroxy-3-chloropropyl and 2,3-oxopropyl; R9 is selected from hydrogen and C₁ to C₆ alkyl; n is 1 to 120; and X is a halogen atom.

61. (previously presented) A demulsifier composition comprising oligo- and polymeric compounds comprising terminal epoxide groups, wherein said oligo- and polymeric compounds are selected from the group consisting of reaction products of an epoxide or glycidyl compound, or a mixture thereof, said epoxide or glycidyl compound selected from the group consisting of aliphatic or cycloaliphatic compounds having two reactive epoxide groups and about 0.8 to about 1.3 molar equivalents of an amine having only two reactive amino hydrogens selected from the group consisting of 2-(2-aminoethoxy) ethanol and tris(hydroxymethyl)aminomethane and mixtures thereof.
62. (currently amended) ~~The A demulsifier composition of claim 61~~ comprising the oligo- and polymeric compounds, wherein the oligo- and polymeric compounds are selected from the group consisting of reaction-products of the reaction of a) a glycidyl compound, said glycidyl compound selected from the group consisting of diglycidyl ethers of aliphatic diols and b) about 0.8 to about 1.3 molar equivalents of a mixture of amines having only two reactive amino hydrogens, said mixture of amines consisting of 2-(2-aminoethoxy) ethanol or tris(hydroxymethyl)aminomethane and mixtures thereof and a second amine monomer having only two reactive amino hydrogens and a tertiary amine group and c) optional subsequent reaction of terminal epoxy groups of the oligo- and polymeric reaction products with an amine capping monomer, having one or two reactive amino hydrogens.

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63. (previously presented) A demulsifier composition comprising oligo- and polymeric compounds comprising terminal epoxide groups, wherein said oligo- and polymeric compounds are selected from the group consisting of the oligo- and polymeric reaction products of a) a glycidyl compound, said glycidyl compound selected from the group consisting of diglycidyl ethers of aliphatic diols and b) about 0.8 to about 1.3 molar equivalents of a mixture of amines, said mixture of amines consisting of a first amine-containing monomer having only two reactive amino hydrogens and a second amine-containing monomer having only two reactive amino hydrogens and at least one tertiary amine.